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## IV.

### *Remarks on the Latest Form of the Development Theory.*

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(Communicated March 27, April 10, and May 1, 1860.)

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It is a familiar truth in palæontology, that the various races or species of animal and vegetable life which now tenant the earth, or have formerly tenanted it, did not originate all at once, but have been introduced at different and widely separated epochs. Those of which the remains are entombed in the earlier fossiliferous strata are now all, or nearly all, extinct; only a very few among the Invertebrates have living representatives at the present day. And as the process of extinction was not sudden or sweeping, but gradual and protracted, so the new species appeared in succession, after long intervals of time, to fill the vacant places. "It appears," to adopt Sir C. Lyell's language, "that from the remotest periods there has been ever a coming in of new organic forms, and an extinction of those which pre-existed on the earth; some species having endured for a longer, others for a shorter time; while none have ever reappeared after once dying out." The species which are now in existence belong, geologically speaking, to comparatively recent times; indeed, none of the higher orders among them are found in a fossil state at all.

Only two theories are possible as to the origin of all the species which have thus been successively introduced upon the earth. The one refers the beginning of each to a special act of creative power. The work of creation, upon this view, was not begun and ended at one time, but has been frequently renewed and extended, no period being without some manifestations of it in the appearance of new forms of life. This doctrine rests upon the fact, confirmed by all observation, that, in the ordinary process of reproduction, each species gives birth only to those of its own kind. It is contrary to

universal experience, in the case of well recognized and perfectly distinct species, that fertile offspring, capable of continuing their own race, should be specifically different from their parents. Accordingly, if a new form or species appears, it cannot have been produced by ordinary generation, but must have been specially created.

The other theory, resting mainly upon obscure and anomalous cases, or upon processes supposed to be of so great length that man cannot have witnessed the beginning and end of them, assumes that various species have been developed out of one another by ordinary descent, the progeny appearing, either immediately or after many generations, specifically different from their parents or ancestors. According to this view, the multiplication of species takes place by a process perfectly analogous to that of the multiplication of individuals of the same species, though it is more infrequent or requires a greater length of time for its completion. This is the Development Theory, so called, which has been maintained, with various modifications, by Maillet, in a work called the "*Telliamed*," by the French naturalist, Lamarck, by the English author of the "*Vestiges of Creation*," and in its latest form by Mr. Charles Darwin. The earlier forms of it have been rejected by the wellnigh unanimous verdict of the scientific world; the latest has been urged with so much ability and candor, and has already found so many adherents, that it merits distinct and respectful consideration.

Mr. Darwin's theory of the origin of species by development really consists of five distinct steps or processes, which need to be sharply distinguished from each other, though two or more of them are often confounded under the same name.

1. *Individual Variation*. — It is a well-known fact, that individual plants and animals are occasionally found to vary by slight peculiarities from the general type of the race or breed to which they belong. The offspring is made a little bigger or a little smaller than its parent; or some organ, member, or limb is abnormally repeated or deficient, or wrongly placed, or unusually developed whether by excess or defect.

2. *Inherited Variation*. — Generally, these abnormal traits are found only in the individuals in which they first appear, the offspring of these reverting immediately to the ancestral or common type. Sometimes, they are continued by descent through two or three generations, and then finally disappear. Less frequently, if at all, they are continued by inheritance indefinitely, so as to become the distinguishing mark of a peculiar breed. Mr. Darwin's theory rests exclusively upon those which are thus *perpetuated* by inheritance; "any variation," he says, "which is not inherited is unimportant for us."

3. *Cumulative Variation*. — One peculiarity having been perpetuated by inheritance, it is assumed that another may be superinduced upon it by a perfectly analogous

process, and then a third, and so on indefinitely; so that the divergence from the parent stock, at first slight and unimportant, may be extended as far as we please, till it will bridge over the interval between the two extremes of animal life. Thus, if time enough be allowed for the process, we can account for the development of man himself out of a zoöphyte.

4. *The Struggle for Life.* — Every species of animal and vegetable life, the human species included, can multiply its own numbers without end, this capability being always exercised according to the law of a geometrical progression. If it were exerted to the utmost, without any check from external circumstances, any species might be so multiplied that it would soon need to occupy the whole face of the earth. But as this power is possessed by all, there must be perpetual competition between them for the ground and for food. A battle for existence is constantly going on, the stronger species always tending to push out the weaker, the one better adapted to the locality or the strife forever usurping the place of its less qualified rival. Hence the extinction of the countless races whose existence is now known only from their remains imbedded in the rocks.

5. *Natural Selection.* — Through the three processes of Variation, Nature is perpetually furnishing fresh combatants for this unceasing strife; and any peculiarity, however slight, of one of the new races, may be a source of strength or weakness, and thus lead to victory or defeat in the contest, — that is, to the preservation or extinction of one or more parties to it. Each variation, if it be an improvement in the adaptation of an organ to a function, or of a species to its locality or environment of circumstances, will tend to preserve the race; if the opposite, to kill it out. Thus the nicest adaptations of means to ends are accounted for, without any necessity of supposing that they were intentional or designed. The success, however insured, of any new-comer over its immediate competitor, is often attended with a train of consequences fatal to the continuance of a whole set of pre-existent species, and favorable to the ultimate introduction of new ones in their place.

It appears from this analysis, that the appellation which Mr. Darwin has given to his own theory is a misnomer. He calls it “the Origin of Species *by Means of Natural Selection*, or the Preservation of Favored Races in the Struggle for Life.” But it is evident that *the origin* of species is fully accounted for, if at all, by the first three steps of *Variation*, which alone explain the introduction and indefinite multiplication of new forms of life; of the two remaining steps, one, the Struggle for Life, is of use only to account for *the extinction* of species formerly in being, and the other, Natural Selection, is adduced merely to explain that nice adaptation of means to ends, so ap-

parent throughout the animal and vegetable kingdoms, which has been held to prove design, and so to evince the intelligence of the Creative Cause. A theorist who denies the necessity of any intervention of such a Cause at any period subsequent to the introduction of the first poor germ of life upon the earth is, of course, bound to show how these adaptations became so numerous and so perfect; and Natural Selection is the very ingenious hypothesis which Mr. Darwin has framed for this purpose.

The state of the evidence upon each of these five points, and the bearing of each upon the main question, may be briefly summed up as follows:—

1. Individual Variation is the one admitted fact upon which the whole theory rests, but which, considered in itself alone, does not aid us at all in the attempt to explain the introduction of new *races* of being. It accounts for the appearance of new *individuals*.

2. Inherited Variation is more questionable, the general rule undoubtedly being that peculiar and anomalous features—deformities, monstrosities, or *lusus nature*, as they are often termed—are either not transmitted at all by descent, or disappear in the course of two or three generations. Whether they disappear because a congenital peculiarity, like an acquired one, such as a scar, a callus, or a stiffened joint, not affecting the organs of reproduction, has no tendency to reproduce itself in the offspring; or because the monstrosity is itself a sign or a consequence of some weakness or defect of constitution, whereby the varying individual is rendered less capable than others of continuing its kind; or because the necessary crossing of the altered breed with one that is unaltered soon reduces the abnormal growth to nothing; or that breeding in and in, which results from the avoidance of crossing, so weakens the stock that it soon ceases to be fertile; or whether several of these causes combined hasten the work of extinction,—certain it is that Nature makes haste to eliminate these departures from type, and to preserve her own original stamp unchanged. Art may to some extent, and with much painstaking, counteract Nature, laboring to preserve and continue the abnormal developments which happen to suit man's convenience or fancy through enforced isolation and regimen, diligent culture, or multiplying or changing the food; but the very necessity of adopting these expedients shows the *tendency* of Nature to be the other way, towards the extinction of the forced growth. As Mr. Darwin himself remarks, "sterility is the bane of our horticulture;" and with all the care and skill of the most expert breeder of cattle, the progeny of his best specimens often disappoint his expectations, and show an unmistakable tendency to revert and degenerate.

Of course, it is admitted that what are called permanent "Varieties" exist, which, with but few precautions, may be made to breed true; but that these so-called "Varie-

ties" originated in Individual Variations perpetuated by inheritance, or that they were not just as much original or special creations as the Species themselves under which they are ranked, is matter only of hypothesis and conjecture. With respect to the numerous "Varieties" of our dogs, horses, sheep, goats, pigeons, &c., Mr. Darwin "believes," or is "doubtfully inclined to believe," or is "fully convinced," that they came either from one wild stock, or from several; or he "can form no opinion" on the subject. But science cannot be made to rest on mere "opinion." That we cannot trace the history of these Varieties *ab origine* is confessed. We cannot trace the stream to the fountain-head; but we can follow it far enough to be sure that it has remained unchanged for thousands of years. The greyhound existed under the form which it now bears at least as early as some of the oldest sculptures in Egypt; and various "breeds" of pigeons were pets of the Pharaohs about five thousand years ago.

3. But with whatever success the doctrine of Inherited Variation may be applied to explain the existence of *Varieties*, it is certain that the origin of *Species* can be accounted for on the Development Theory, if at all, only by Cumulative Variation,—that is, only by supposing a vast number of Inherited Variations to be successively superinduced one upon another. Doubts have been raised upon this point only on account of ambiguity in the meaning of words, or from want of agreement as to the principles of classification. Many races, both of animals and vegetables, appear to be so nearly allied to each other, that certain naturalists consider them as mere Varieties; others persist in considering them as so many distinct Species. Mr. Darwin himself remarks (pp. 49, 50, Am. ed.), that the distinction between Varieties and Species is "entirely vague and arbitrary"; and says, in reference both to plants and animals, "that many forms, considered by highly competent judges as Varieties, have so perfectly the character of Species, that they are ranked by other highly competent judges as good and true Species." Fortunately we do not need, so far as our main question is concerned, to enter into the intricacies of this discussion. The advocates of the Development Theory undertake to prove that *all* Species of animals, even those differing most widely from each other, "have descended from at most four or five progenitors, and plants from an equal or lesser number." Putting aside altogether, therefore, the much debated question whether the several races of men are only Varieties, or are so many distinct Species, and the same question with respect to dogs, there is no doubt that men and dogs belong respectively to different Species. And generally, putting aside the question whether the offspring of certain races when crossed are entirely sterile or only partially so, there is no doubt that animals or plants belong to distinct Species when they cannot be crossed or made to interbreed at all. It is enough to say, then, that only Cumu-

lative Variation — and that of a vast number of successive steps — will account for the common origin of animals which will not copulate with each other, or of plants which cannot be crossed.

Now, on this cardinal point, which contains the essence of the Development Theory, since all the other questions involved in it are of no substantive importance, so far as what may be called the Philosophy of Creation is concerned, the direct evidence fails altogether, and we are left exclusively to the guidance of conjecture and analogy and estimates of what is possible for all that we know to the contrary. It is not even pretended that we have any direct proof, either from observation or testimony, that two Species so distinct that they will not interbreed have yet sprung from common ancestors. On the contrary, Mr. Darwin's own supposition is, that the process of developing two entirely distinct Species out of a third is necessarily so gradual and protracted as to require a *quasi* eternity for its completion, so that only a small portion of it could have been accomplished during the limited period of man's existence upon the earth.

In the absence of any direct proof, then, it remains to be inquired if there are sufficient grounds of probability, reasoning from analogy and the principles of inductive logic, for believing that all Species of animals and plants may have originated from three or four progenitors. In speaking of the amount and frequency of Individual Variation, Mr. Darwin and his followers abuse the word *tendency*. After heaping up as many isolated examples of it as they can gather, they assert the legitimate inference from such cases to be, that the species *tends* to vary, leaving out of view the fact that a vastly larger number of individuals of the same species do not vary, but conform to the general type. And though only one out of a hundred of these Individual Variations is transmitted by inheritance, yet, after collecting as many instances of such transmission as they can find, they affirm that a Variation *tends* to become hereditary. But it is not so. *Tendency* is rightly inferred only from the *majority* of cases; a small minority of favorable instances merely shows the *tendency* to be the other way. Thus, the cars do not *tend* to run off the track, although one train out of a thousand may be unlucky enough to do so; but the general law is, that they remain on the track. Otherwise, people would not risk their lives in them. So a considerable number of children have been born with six fingers on each hand, and a still greater number with harelips. And yet we say that the *tendency* is for each hand to have only five fingers, and for the upper lip and palate to be closed. The advocates of the Development Theory violate the first principles of inductive logic, by founding their induction not, as they should do, on the majority — the great majority — of cases,

but on the exceptions, the accidents. Their whole proceeding is an attempt to establish a philosophy of nature, or a theory of creation, on anomalies, — on rare accidents, — on *lusus naturæ*.

This single objection is fatal to Mr. Darwin's theory, which depends on the accumulation, one upon another, of many successive instances of departure from the primitive type. For if even Individual Variation appears only in one case out of a hundred, — and all naturalists will admit this proportion to be as large as the facts will warrant, — and if, out of the cases in which it does appear, not more than one in a hundred is perpetuated by inheritance, then should a second Variation happen, what chance has it of leaping upon the back of one of the former class? The chance is one out of  $100 \times 100 \times 100 = 1,000,000$ . And the chance of a third Variation being added to a second, which in turn has been cumulated upon a first, will be one out of 100 raised to the fourth power, or 100,000,000. It is not necessary to carry the computation any further, especially as Mr. Darwin states (page 90) that the process of development can be carried out "only by the preservation and accumulation of infinitesimally small inherited modifications." Of course, the interval between two Species so distinct that they will not interbreed could be bridged over only by a vast number of modifications thus minute; and on this calculation of the chances, the time required for the development of *one* of these Species out of the other would lack no characteristic of eternity except its name. But the theory requires us to believe that this process has been repeated an indefinite number of times, so as to account for the development of *all* the Species now in being, and of all which have become extinct, out of four or five primeval forms. If the indications from analogy, on which the whole speculation is based, are so faint that the work cannot have been completed except in an infinite lapse of years, these indications practically amount to nothing. The evidence which needs to be multiplied by infinity before it will produce conviction, is no evidence at all.

4. What is here called the "Struggle for Life" is only another name for the familiar fact, that every Species of animal and vegetable life has its own Conditions of Existence, on which its continuance and its relative numbers depend. Remove any one of these Conditions, and the whole Species must perish; abridge any of them, and the number of individuals in the Species must be lessened. The intrusion of a new race which is more prolific, more powerful, more hardy, or in any way better adapted to the locality, may gradually crowd out some of its predecessors, or restrict them within comparatively narrow bounds. Thus the introduction of the Norway rat has banished the former familiar plague of our households and barns from many of its old haunts, and probably reduced the whole number in this Species to a mere fraction of what it once was.



Civilized man also has successfully waged war against many ferocious or noxious animals, and probably exterminated some of them. But the appearance of a rival or hostile race is not the only cause of such diminution or extinction. A change in the physical features of a given district may partially or entirely depopulate it, without the necessary introduction of any new-comers. The drying up or filling up of a lake is necessarily fatal to all its aquatic tribes. The gradual submergence of an island or a continent must exterminate, sooner or later, all the native Species which were peculiar to it. And at the utmost, the failure of any Condition of Existence, whatever may be its character, only leaves vacant ground for the future introduction or creation of new forms of life, without tending in the slightest degree to bring such new forms into existence.

5. Natural Selection, also, as already remarked, has nothing to do with the *origin* of Species, and, in its abstract form, is only the statement of a truism. Of course, when two or more Species crowd each other, the more prolific or the more vigorous, other things being equal, is more likely to gain possession of the disputed ground, and thus to diminish the numbers of the other, or oblige it to migrate, or, in rare cases, to kill it out altogether. But this last supposition is a conceivable rather than a probable result. All observation goes to show, that every Species retains a very persistent hold upon life, however feeble may be the tenure of existence for its individual members. Its numbers may be materially diminished; it may be forced to shift its ground, and to suffer in consequence some slight change in its habits; (Mr. Darwin himself tells us of upland geese and of woodpeckers where there are no trees;) it may be driven into holes and corners; but somehow it still survives. Utter extinction of a Species is one of the rarest of all events; not half a dozen cases can be enumerated which are known to have taken place since man's residence upon the earth. And these, surely, are a very insufficient basis on which to found a theory embracing all forms of life. Yet man is the greatest exterminator the world has ever known. His physical powers, coupled with the use of reason by which they are multiplied a thousand-fold, enables him to wage internecine war with comparative ease against nearly every race that molests him. Only the insect tribes, through their immense numbers and their littleness, can successfully defy him; and these not always. In *his* Struggle for Life, all other creatures, animal or vegetable, must retreat or perish. Yet how few has he rooted out altogether! But the Development Theory requires us to believe that this process of extinction, guided by Natural Selection, has been repeated wellnigh to infinity. Not only all the races which are now found only in their stone coffins, but countless others, — “the interminable number of *intermediate* forms which must have

existed" as connecting links, and a still greater crowd of other Varieties not intermediate, but gross, rude, and purposeless in their formation, — the unmeaning creations of an unconscious cause, — must all have perished, each through its own peculiar repetition of a series of events so infrequent that we can hardly compute the chances of their happening at all.

It is easy to see why the extermination of a Species, even upon the conditions of Mr. Darwin's theory, should be so infrequent. He holds that all the races which have originated upon the earth since the primeval act of creation first grudgingly threw only four or five seeds of existence into the ground, have been shaded into each other by gradations so slight as to be nearly imperceptible. Differing so slightly from each other, the advantage possessed by any one of them in the Struggle for Life must have been almost indefinitely small. But a peculiarity important enough to preserve those who have it, while whole Species must die out because they have it not, cannot be thus trifling in character. It must have been one of grave moment; not a slight Variation, but a jump. The successive development of new races — itself, as we have seen, an extremely slow process — must have been continued through numerous steps, before the divergence resulting from it could have been serious enough to enable one of the divergent stocks to overcome and exterminate the other. Numerous Species of the same genus now coexist, often within the bounds of a not very extended territory, without any one of them showing any tendency to supplant or exterminate another. Thus, South Africa is the country *par excellence* of the antelope; about fifty species of this animal have been found there, many of them very abundant, notwithstanding the numerous *Carnivora* that prey upon them, and yet none of them showing any tendency to die out before civilized man came thither and brought gunpowder along with him.

Natural Selection can operate only upon races previously brought into being by other causes. In itself, it is powerless either to create or exterminate. In the Development Theory, its only function is, when the number of different Species is so far multiplied that they crowd upon each other, and the extinction of one or more becomes inevitable (if we can conceive of such a case), then to make the *selection*, or to determine which shall be the survivors and which the victims. As individuals of the same Species, the same Variety, and even of the same flock, certainly differ much from each other in strength, swiftness, courage, powers of endurance, and other qualities, Natural Selection has an undoubted part to play, when the struggle comes for such a flock, in determining which of its members shall succumb. But that it ever plays a corresponding part in the grand contest of Species imagined by Mr. Darwin, is a supposition

resting upon no evidence whatever, but only upon the faint presumption afforded by the fact, that certain Species at widely separated times have become extinct, through what causes we know not ; and therefore, for all that we know to the contrary, Natural Selection may have had something to do with their disappearance. This is to found a theory, not upon knowledge, but upon ignorance. If such reasoning be legitimate, we are entitled to affirm that the moon is inhabited by men “whose heads do grow beneath their shoulders.” It may be so, for all we know to the contrary.

This review of the state of the evidence upon each of Mr. Darwin's five points is enough to show that the testimony fails entirely just where it is most wanted. Facts and arguments are accumulated where they are of little or no avail, because the conclusions to which they tend, when properly limited and qualified, are admitted and familiar principles in science. But the theory of the Origin of Species *by Cumulative Variation*, which is all that is peculiar to this form of the transmutation hypothesis, rests upon no evidence whatever, and has a great balance of probabilities against it. Individual Variation, the Struggle for Life, and Natural Selection, each within clearly defined limits, are acknowledged facts, which still leave the main question in the philosophy of creation precisely where it was before ; and even the doctrine of Inherited Variation relates only to the *origin of Varieties*, which is a distinct question, and one of subordinate importance and interest, except to naturalists. Mr. Darwin has invented a new scheme of cosmogony, and finds that, like other cosmogonies, it is a blank hypothesis, not susceptible either of proof or disproof, and needing an eternity for its development. There is nothing new in such a speculation of what is possible in an infinite lapse of years. This latest form of the speculation has no advantage over the one first propounded some three thousand years ago ; — that a chaos of atoms, moving about fortuitously in infinite space, may have happened, in an eternity, to settle into the present kosmos ; for the chance of order and fitness is at least one out of an infinite number of chances of disorder and confusion ; and in an infinite series of years, this solitary chance must sooner or later be realized. Mr. Darwin begins, not with a crowd of inorganic atoms, though consistency required him to do so, but with four or five primeval organisms very low down in the scale, — say zoöphytes and mollusks ; and supposes these to multiply and to vary their organization at random, each Variation, if an improvement, being preserved, and if useless or injurious, being killed out by Natural Selection ; and thus, in an eternity, the present kosmos of animal and vegetable life may have been perfected, not exactly out of chaos, but out of very few and poor rudiments, without the necessary intervention anywhere of an intelligent Creative Cause.

Every such speculation must be rejected, because it is self-contradictory. It professes to develop a Theory of Creation, — to explain the beginning of things; and in order to do so, it is obliged to assume that the present or ordinary succession of phenomena, the common sequence of causes and effects which we every day witness, has continued from eternity; — that is, that there never was any Creation, and that the universe never began to be. It professes to untie the knot, and ends by denying that there is any knot to untie. Mr. Darwin is too imaginative a thinker to be a safe guide in natural science; he has unconsciously left the proper ground of physics and inductive science, and busied himself with questions of cosmogony and metaphysics.

We are at liberty, then, to consider the relations of this Development Theory to the great doctrines of philosophy and theology, without shifting the question or seeking to place it upon any other grounds than those upon which the author himself bases it; — above all, without seeking to build up an argument *ad invidiam*, a purpose which is here emphatically disclaimed.

Most interesting and important among these relations is its bearing upon the doctrine of Final Causes. The denial of such Causes — that is, the doctrine that purpose, intention, or design is nowhere discoverable in organic nature — has been reproachfully urged against some naturalists, on account solely of the tendency of such denial to weaken the arguments of the theist. Of course, it does have such an effect, for what has ever been the principal, most intelligible, and most popular argument for the being of a God rests entirely upon the assumption that adaptations, especially if nice and complex, *prove* design, or must have been intended. But it is a mistake to suppose that Final Causes have no use or meaning in philosophy and science, apart from this application for a theological purpose. Aristotle first described and designated them, distinguishing them from the three other sorts of causes (Material, Formal, and Efficient), without even hinting at their bearing on the doctrine of the theist; while Harvey successfully used the assumption of a Final Cause as an instrument of discovery, and Cuvier did the same; and it is in reference only to such use, viz. as instruments of physical research, that Lord Bacon condemned the study of Final Causes.

And here it may be observed, that palæontologists, like Mr. Darwin and Sir Charles Lyell, cannot, without gross inconsistency, repudiate the doctrine of Final Causes; for in so doing, they deny the justice of the very inference, or assumption, call it which you may, on which their whole science is based. Geologists have no better reason, and no reason of a different kind, for affirming that *fossil* animals and plants did once, millions of years ago, exist as *living* animals and plants, than philosophers and theolo-

gians have for declaring that the animal and vegetable kingdoms — i. e. God's works — show purpose and intention just as clearly as man's works do. No direct proof is possible in either case. The only argument is from analogy and an appeal to common sense. The sceptic may defy Mr. Darwin to prove *directly*, that the Silurian fossils did not exist primarily, *ab origine*, in the rock where we now find them, — composed of stone, as they now are. For, take the doctrine of Democritus and Epicurus, which, as already intimated, is the progenitor of this Development Theory. If the mere fortuitous concourse of atoms, in the lapse of a past eternity, can have formed a *living* tree, fish, or elephant, then, we say, that same rudderless and purposeless crowd of primeval atoms, in the lapse of a past eternity, can have formed, what is much easier, a fossil tree, fish, or elephant, *as fossils*.

Yet Mr. Darwin assumes the previous existence of these fossils in a living state, as a means of building up a theory which shall enable him to assert that “a structure even as perfect as the eye of an eagle might be formed by natural selection;” — that is, without any special design or intention to create an organ of vision. He admits that “it is scarcely possible to avoid comparing the eye to a telescope. We know that this instrument has been perfected by the long-continued efforts of the highest human intellects; and we naturally infer that the eye has been formed by a somewhat analogous process.” But he asks, “May not this inference be presumptuous? Have we any right to assume that the Creator works by intellectual powers like those of man?” (p. 169.) But this is not the question. There is just as much “presumption” in assuming to determine that the Creator *ought not* to work in a given manner, or through certain “intellectual powers,” as in taking it for granted that he *would* or *must* employ such means. In either case, this is assuming to set bounds to Omnipotence, and to prescribe how Infinite Wisdom ought, or ought not, to act. Our only business, as students of natural science, is to follow the evidence wherever it may lead us, and to be consistent in the inferences which we draw from it, leaving it to philosophers and theologians to reconcile, if they can, our conclusions with their preconceived ideas of what is becoming to the Creator. If they cannot reconcile them, so much the worse for their preconceived ideas. Our only question is, Whether it is consistent to infer, from a general analogy of structure with living forms at the present day, that certain fossilized skeletons were living organisms millions of years ago, though we confidently deny, in spite of the far more striking analogy between an eagle's eye and a telescope, that an intelligence presided over the formation of the one similar to that which we know to have concurred in the production of the other? Can we justly infer life from a general analogy of structure, while we refuse to infer intelligence from

a far more obvious analogy in the adaptation of means to ends? Mr. Darwin and Professor Baden Powell answer this question in the affirmative; and it is for them to defend their consistency as they may.

The purpose of the Development Theory, in any of its forms, is to exclude the necessity of believing in any special creative act, or any exertion of intelligence and will, and to refer all physical phenomena, the first appearance of new and distinct races included, to the continuous and uninterrupted action of what are called secondary causes or natural laws. In pursuance of this purpose, even the primitive act of creation, by which the universe was first evolved out of nothingness or out of a chaotic mass, is either denied, or, what is the same thing, is removed to an infinite distance. An *absolute beginning*, either of the universe, or of any Species of animal or vegetable life in the universe, is, on this Theory, an impossible or inadmissible conception. Alluding to the opponents of this doctrine, Mr. Darwin observes (p. 418), "These authors seem no more startled at a miraculous act of creation than at an ordinary birth. But do they really believe that, at innumerable periods in the earth's history, certain elemental atoms have been commanded suddenly to flash into living tissues?" And Professor Powell still more distinctly remarks, "that strict science offers no evidence of the *commencement* of the existing order of the universe. It exhibits, indeed, a wonderful succession of *changes*, but however far back continued, and of however vast extent, and almost inconceivable modes of operation, still only *changes*; occurring in *recondite order*, however little as yet disclosed, and in obedience to physical laws and causes, however as yet obscure and hidden from us. Yet in all this there is no *beginning* properly so called: no commencement of existence when nothing existed before: no *creation* in the sense of origination out of non-existence, or formation out of nothing. Even without referring to that metaphysical *conception*, or more properly metaphysical *contradiction*, to imagine anything which can be strictly called a *beginning*, or first formation, or endowment of matter with new attributes, or in whatever other form of expression we may choose to convey any such idea, *is altogether beyond the domain of science*, as it is an idea beyond the province of human intelligence." \*

Still it might be maintained that, although science gives us no glimpse of a Creator, it does point to an Architect of the universe, in so far as it discovers and analyzes the innumerable and marvellous adaptations of means to ends by which this earth is rendered a fitting and convenient habitation for all the tribes that tenant it, and by which

\* Rev. Baden Powell's "Order of Nature," (London, Longmans, 1859,) pp. 250, 251. In this quotation the words are italicized as in the original.

the organization of each plant and animal is nicely adjusted to the place which it occupies, and the work which it has to perform. To rebut this conclusion, Mr. Darwin brings forward his improvement of the transmutation theory, in which, as already remarked, the office of Natural Selection is to explain and account for all natural adaptations and adjustments, even the nicest and most complex, without any necessity of supposing that they were intentional or designed, and consequently without any need of referring them to the action of an all-wise Architect.

A careless thinker might yet argue, that Natural Selection itself is only an agent of the Deity, or a law established by Him for the very purpose of effecting the adaptations which are ascribed to it, and which would therefore still be properly regarded as the work of Him by whose will and instrument they were fashioned. But such an argument would betray only confusion of thought. For Natural Selection is neither a created thing, nor a cause, nor a law dependent on the volition of a lawgiver; but it is an abstraction and a generalization. It is not Natural Selection that kills out one or more Species and preserves others; but climate, food, space, enemies,—or the want of them,—these do the work of killing or preserving. God no more created or enacted the law of Natural Selection, than he created or enacted the Binomial Theorem. The Binomial Theorem is the necessary result of the necessary relations of numbers, and even Omnipotence could not abrogate it. Just so, Natural Selection is the inevitable result of the relations of animals to their conditions of existence; or rather, it is a general expression for these relations themselves; and thus Omnipotence could not abrogate it. Change the climate, food, space, enemies, &c., and Natural Selection would still act, but would kill where it now preserves, and preserve where it now kills. Thus, the results of the Theory are necessary or fatalistic; they blot God out of creation everywhere.

Moreover, in regard to the peculiarities, or Individual Variations, on which the Theory is based, and on which this principle of selection is to operate, there is an equal exclusion of intelligence and will, and even of law and order. As already explained, these peculiarities are the exceptions and monstrosities,—the phenomena which least of all admit of being reduced to law, or referred to the action of any uniform cause. These aimless and exceptional *lusus naturæ*, as they appear to most observers, form the chaos or rude matter of the Development Theory, on which the principle of Natural Selection, like the *deus ex machina*, is to operate, and evolve order out of confusion and complex adaptations out of accident. In fact, this principle would have nothing to do,—it would not be *selection*,—if the Individual Variations were not multiplied at random, and were not purposeless in character. The essence of the hypothesis is, that

“there is a power always intently watching each slight *accidental* alteration,” (p. 169,) and finding a use or fitness where none was intended ; just as a savage, wandering on a sea-beach, may, after long search, find a stone which has a rude semblance of a chisel or an axe, and use it as such. Hence Mr. Darwin speaks consistently (p. 79) of “giving *a better chance* of profitable Variations occurring ; and unless profitable Variations do occur, Natural Selection can do nothing.” But they will occur, for “Variation will cause the slight alterations, generation will *multiply them almost infinitely*, and Natural Selection will pick out with unerring skill each improvement,” (p. 169,) separating it from countless others which are not improvements, but, as useless or injurious, are to be eliminated. “*Mere chance*, as we may call it, might cause one variety to differ in some character from its parents.” (p. 104.) True, it is afterwards explained that *chance*, as here used, does not negative a cause. No one supposed that it did ; but it does negative any purpose or intelligence in that cause ; and Mr. Darwin intimates nothing to the contrary.

There can be no mistake as to the character of such a scheme of cosmogony as this. Creation denied, or pushed back to an infinite distance, and a blind or fatalistic principle watching over a chaos of unmeaning and purposeless things, and slowly eliciting from them, during an eternity, all the order and fitness which now characterize the organized world.

“It cannot be objected that there has not been time sufficient for *any amount* of organic change ; for the lapse of time has been so great as to be utterly inappreciable by the human intellect.” (p. 402.) Having cited the speculations of the “uniformitarian” geologists upon the long roll of ages, “the millions on millions of years” needed for the explanation of geological phenomena, according to their mode of reading them, it seems a trifling matter for him to ask us to admit, that ages of equal or even greater length may have elapsed, of which we have no record in the rocks ; — that, besides the eternity of which we have some sort of geologic evidence, we should acknowledge the probable lapse of another eternity that has left no legible traces behind it, but which happens to be necessary for the purposes of his theory. “Consequently,” he says, “if my theory be true, it is indisputable that, before the lowest Silurian stratum was deposited, long periods elapsed, as long as, or probably far longer than, the whole interval from the Silurian age to the present day ; and that during these vast, yet quite unknown, periods of time, the world swarmed with living creatures.” (p. 268.) “At a period immeasurably antecedent to the Silurian epoch, continents *may* have existed where oceans are now spread out ; and clear and open oceans *may* have existed where our continents now stand.” (p. 270.)



Such speculations as these appear to be rather exercises of fancy than sober inferences of science. A mere hypothesis of indefinite Cumulative Variation, resting upon analogy, in the absence of all direct proof, must be allowed also to *create its own evidence* of the inconceivable lapse of time requisite for its development, instead of drawing that evidence from distinct and independent sources.

Professor Powell, in his advocacy of the Development Theory, argues at length against the doctrine of Final Causes ; but there is only one sentence in Mr. Darwin's volume from which we can infer the nature of his objections to the same doctrine. Speaking of the facts included under the general name of Morphology, he says, "Nothing can be more hopeless than to attempt to explain this similarity of pattern in members of the same class, by utility or the doctrine of Final Causes." Admitting for the moment the correctness of this assertion, what does it amount to? Surely it will not be maintained, that because Final Causes cannot be *discovered everywhere*, therefore they do not *exist anywhere*. No one will contend, that because we cannot see the use of the rudimentary mammæ in the male, *therefore* the corresponding organs in the female are not adapted to the suckling of her young. As well might it be argued that the rain does no good in moistening the parched earth, because other rain-drops are seemingly wasted by falling into the sea. To the reflecting theist, the general similarity of structure declares the unity of the Creator, without contradicting the lessons taught by special adaptations respecting His benevolence and forethought. To borrow Mr. Darwin's own example : — "What can be more curious," he asks, "than that the hand of a man formed for grasping, that of a mole for digging, the leg of a horse, the paddle of the porpoise, and the wing of the bat, should all be constructed on the same pattern, and should include the same bones, in the same relative position?" (p. 377.) Of course, by "the same" pattern, "the same" bones, and "the same" relative position, Mr. Darwin means a *similar* pattern, *similar* bones, position, &c. ; that is, that the pattern, bones, and position are alike in part, and different in part. Granted, then, that the doctrine of Final Causes will not explain the likeness ; will that of Morphology explain the difference? The typical anterior limb is modified in many different ways, so as to become adapted to the wants of animals with different habits ; it becomes a hand for man, a shovel for a mole, a paddle for a porpoise, and a wing for a bat. The similarities in the pattern or groundwork are referred to one principle in science, Morphology ; the peculiarities in each special adaptation, to another principle, that of Final Causes. Both the like and the unlike are constituent parts of one structure ; they are referred respectively to different, but not contradictory principles ; and since neither of these principles is competent for the explanation of the

whole work, we see not why one of them should be accepted to the rejection of the other. Guided by the doctrine of Homologies, the comparative anatomist searches for corresponding parts in different animals; guided by that of Final Causes, whenever he finds a marked peculiarity in one part, he suspects there is a special use or function to be subserved by it; and by persevering in the search, he usually finds out what this use is. Thus, Harvey found that the valves in the veins and arteries opened in opposite directions; and assuming that this difference could not be without a use or purpose, he discovered the circulation of the blood. Homologies may be the better guide to systems of classification of parts and members, though naturalists are not agreed upon this point. But the principle of Final Causes more frequently leads to discoveries in physiology, which science, indeed, has been built up almost exclusively by its aid.

The theist believes, it is true, that a Creator of infinite wisdom and benevolence has made nothing in vain; that there is a use for everything, and a use which it was intended to serve. But he cannot assert that he has discovered this use and fathomed this intention in every instance, without assuming that he possesses infinite wisdom himself. And the naturalist who, because he cannot discover the use, affirms that it does not exist, is guilty of similar presumptuous folly. Looking at the works of finite intelligence, indeed, we find that a purpose is seldom unaccompanied by a want of purpose; that chance appears, so to speak, as the *residuum* of design. Thus, we often throw a stone, not intending to hit anything with it, but only to toss it out of the way. The throwing was intentional, the hitting was accidental. Every act is attended with several immediate results; and as all of them are not necessarily in view of the agent at the time, those which do not enter distinctly into his purpose are ascribed to chance. They are caused by him, but not intended by him. A mechanic cannot fashion a machine, an artist cannot chisel out a statue, without leaving behind him a heap of chips, dust, and refuse matter. A chip is struck off at every blow; but neither its shape, nor the position in which it falls, is designed by the artisan, who is thinking only of the work from which he has pared it away. But because we cannot discern either use or purpose in that heap of refuse matter, we are not to conclude that the finished machine or statue by the side of it is destitute of both. Absence of purpose, then, may often be affirmed of the results of human labor; but it can never be declared with certainty of the works of creation. Infinite wisdom leaves no *residuum* for chance, and that which is not subservient to one purpose may have been intended for another. If not useful to the organism in which it is found, it may answer some higher object in the economy of creation. It may be a means, and intended as such,

for the higher education of man, or for the attainment of moral as well as physical ends.

The same remark is applicable for the explanation of another difficulty mentioned by Mr. Darwin. He objects that "all the contrivances in nature are not, as far as we can judge, absolutely perfect, and some of them are even abhorrent to our ideas of fitness." (p. 409.) And he cites, as instances, the sting of the bee causing the bee's own death, the hatred of the queen-bee for her own fertile daughters, and the ichneumonidæ that feed within the bodies of live caterpillars. He might as well have adduced the existence of all the *Carnivora*, man himself included, together with the frequent occurrence of pain and death. We are not wont to hear the old problem respecting the existence of evil alleged as an argument in favor of a novel speculation in zoölogy. But when certain arrangements are declared to be imperfect or unfit, we have a right to ask by what standard they have been tried. Perfect for what end? Fit for what purpose? If the only conceivable intention were to guard the life of every individual bee, perhaps a more effectual means might have been discovered than that of furnishing it with any sting at all. Many insects exist in vast numbers that have no such weapon. Human knowledge, also, is so far from comprehending the whole plan of creation, and all the purposes of its Author, that it seems reasonable to admit the evidences of design where they are so obvious that they cannot be overlooked, and to refer all other cases to our limited means of observation and the imperfection of our faculties. The difficulty, moreover, may be retorted upon the advocates of the Development Theory. As Natural Selection preserves only the useful, and kills out all worthless and noxious Variations, how comes it to have left, in a weapon otherwise so perfect, this one fatal defect, that it cannot be once used without causing the death of its owner?

The necessities of his theory compel Mr. Darwin to maintain that the most complex *instincts*, as well as the nicest adaptations of structure, can have been produced only "by the slow and gradual accumulation of numerous slight, yet profitable, variations." But he has seemingly failed to observe that instinct and structure are nicely correlated to each other, and must be so correlated, or the animal would perish. Consequently, the *variations* of structure and instinct must have been simultaneous and accurately adjusted to each other, as a modification in the one, without an immediate corresponding change in the other, would have been fatal. He has also failed to remember, that the highest and most complex instincts are generally found in very low structural forms; for instance, among bees, ants, and spiders, rather than among vertebrates, and in birds more than in mammals. The progress of improvement, then, in the two cases, cannot have been always by equal and corresponding steps; for the development

of instinct stopped long ago, while the organic structure has advanced from a spider's up to a man's. It is not a law of nature, then, that a change of the organism should always be accompanied by a change of instinct nicely adapted to it; consequently, the Development Theory can offer no explanation of the fact, that the organism must always have harmonized precisely with the instinct, while the latter was slowly perfected by innumerable variations. It is impossible that so nice a correspondence, maintained between the two during countless independent changes of each, should have been purely accidental or unintentional.\*

Those who deny that there has been any special act of creation since living forms first appeared upon the earth, are bound, of course, to account for the origin of the human species, just as much as for that of the lowest insect. Mr. Darwin confesses as much when he says that, after the general reception of his system, "psychology will be based on a new foundation, that of the necessary acquirement of each mental power and capacity by gradation. Light will be thrown upon the origin of man and his history." (p. 423.) He is bound, therefore, to find the means of bridging over, by innumerable slight gradations, the immense gap which now separates man from the animals most nearly allied to him, — a gap not only between the two structural forms, which, however dissimilar, may still be affirmed to be of the same kind, but between reason and instinct, where nearly all psychologists are agreed that the difference is in kind, and not merely in degree. As Sir C. Lyell remarks, "the sudden passage from an irrational to a rational animal is a phenomenon of a distinct kind from the passage from the more simple to the more perfect forms of animal organization and instinct." †

Here an obvious objection occurs, founded upon the comparative shortness of the time during which man has been a resident upon the earth. "Man," says Lyell, "must be regarded by the geologist as a creature of yesterday, not merely in reference to the past history of the organic world, but also in relation to that particular state of the animate creation of which he forms a part." ‡ Even the questionable evidence recently obtained from the discovery of flint knives and arrow-heads in localities where their presence is difficult to be accounted for, does not enable us to ascribe to the human race a higher antiquity than that of the later post-Tertiary formations. Then the interval of time, within which far the broadest chasm which we have to contem-

\* Here, and elsewhere in this Memoir, a few remarks have been repeated, in an abridged form, which were first published in an article contributed by me to the *North American Review* for April, 1860.

† Lyell's *Principles of Geology*, Am. ed. 1853, p. 148.

‡ Ibid., p. 182.

plate in zoölogy is to be filled up by innumerable transitional forms, is certainly the shortest which geology has revealed. As the most recent, also, it is one the history of which is most perfectly known. During this period, certainly, it is in the highest degree improbable that innumerable species should have lived and died out without leaving behind them any trace of their existence. The few fossil monkeys that have been discovered are not so near approximations to the human form as several anthropoid species that are now living. How, then, can man have been developed during this short epoch, by the indefinitely slow process of Cumulative Variation and Natural Selection, out of a monkey? and where are the countless extinct types that should mark the steps of his progress? How many varieties must have existed as strict transitional forms to fill up this broad gap,—to say nothing of the greater, infinitely greater number of variations which were not improvements, but which must also have appeared and died out under a liability to change having no direction or purpose but that of chance! Geology can find no traces of them. The latest chapter of the Stone Book, which is far the best preserved, and which ought to be nearly filled with variations upon this single theme, does not record a single form intermediate between man and the chimpanzee.

Moreover, if reason has been developed out of instinct, these innumerable forms between the *Quadrumana* and the *Bimana* must have had an enormous advantage in the Struggle for Life over their less intelligent competitors, so that the total disappearance of their remains becomes still more inexplicable. Bones of their brute contemporaries, hyenas, bears, rhinoceroses, elephants, and even a few monkeys, are found by the cart-load in many localities. But a crowd of half-reasoning animals, developed out of oranges, chimpanzees, or gorillas, furnished with tools and weapons, and capable, if we may judge from their other semi-human attributes, of adapting themselves to a wide range of circumstances, and which ought, consequently, to have multiplied without stint, because they were sure to triumph over their brute rivals in every contest for the ground or for food, have yet perished so entirely, that not a vestige of their skeletons has been anywhere discovered.

The doctrine that reason has been developed out of instinct, depends entirely upon the assumption that these two faculties differ from each other in degree only, and not in kind. If psychology is to be placed upon a new foundation, as Mr. Darwin assures us, “that of the necessary acquirement of each mental power and capacity *by gradation*,” there must be a conceivable transition from instinct to reason through a number of steps, every one of which must be an improvement. Here we are at once met by the difficulty, that the power of instinct, in many cases, quite transcends that of reason; if

it differs from human intelligence in degree only, it is in these instances undoubtedly the superior. Man may go to school to the spider, the ant, the wasp, and the bee, but he can never equal his teacher. Compare the habitations, the nets, and other structures of these insects, with those of the lower savages, such as the Hottentots and the native Australians, and say which are the more artistic and the more nicely adapted to their purposes; especially when we add the necessary qualification, that the insect works without any tools except those which are parts of its own body. Man has had bitter experience enough in the matters of government and social organization, and the wisdom of thirty centuries has been exhausted in pondering upon the several problems of social philosophy; but he is still unable to form a society which, in point of orderly arrangement, harmony, and effective co-operation for the general good, even approaches the excellence of a hive of bees. Since the latest form of the Development Theory allows no variation to be preserved and perpetuated, except it be an improvement, since Natural Selection inevitably kills out every change except it be for the better, how comes it that human reason has deteriorated in all these respects ever since it began to be built up from the narrow foundations of an insect's instinct? It is no answer to say, that reason is still immeasurably the superior in the number, comprehensiveness, and ductility of its endowments, and especially in those powers of adaptation and invention by which it is fitted for all emergencies. The question still remains, Why, if it has improved in so many respects, has it deteriorated in any?

But the difficulty of accounting for the transmutation of instinct into reason becomes vastly greater, when it is remembered that a leading characteristic of the former is, that it admits of no variation whatever, — that, as far as human observation has extended, it is absolutely unchangeable, both in the individual and in the race. Instinct, it is true, has a certain degree of *pliability*, enough to provide for the ordinary and perpetually recurrent emergencies of the special occasion for which it was created. Otherwise, the faculty would very seldom answer its purpose, or be competent for its destined work. Thus, the spider which always fashions a circular web, as it can seldom or never find a nearly circular opening in which to suspend it, must be able to change the length and direction of the suspending threads, so as to hang the structure easily and economically in an opening of any shape, triangular, quadrangular, or altogether irregular, such as it may best find. But the absolute invariability of the instinct appears even here, in the fact that the web of this spider is always circular and curiously symmetrical, though so much contrivance is thereby needed to suspend it with proper stiffness; and though a triangular web, such as is always spun by an allied species, would remove all difficulty and answer every purpose. The range of this pliability,

also, is always confined within very narrow limits. The instinct is invariably pliable to the same extent, and that a very limited one. Bees and wasps build cells very nearly on the same pattern, which is curiously elaborate and symmetrical; they even change this pattern a little, so as to fit together the cells of different sizes which they need, or to hang securely the topmost or innermost row of cells to the top or side of their habitation; always returning, however, to the typical form of the cell as soon as possible. Bees build invariably with wax, wasps invariably with a paper-like substance, though an interchange of these materials would often be convenient, and a capacity of changing the material on an emergency would certainly conduce to the animal's preservation.

A true *variation*, such as this Theory requires, would be the manifestation by an individual in the wild state, or undomesticated, of some feat, quality, or degree of instinct, however slight, totally unlike anything that had been manifested by its fellows. Of such variation the observations of naturalists have not afforded us a single instance. The architecture and internal economy of a beehive or a wasps' nest, so far as known, marvellously complex and elaborate as they are, have not varied by a hair's breadth since the days of Aristotle. Bees have been carefully watched by man for over two thousand years; they have been carried by him to a vast number of localities beyond those originally inhabited by this insect. The whole continent of America has been populated by the ordinary hive-bee from Europe. Thus the experiment, whether change of circumstances might not possibly induce variation, may be said to have been fairly tried. There are from 15,000 to 20,000 bees in every healthy hive; and the number of their hives, taking all parts of the world together, almost defies calculation. This enormous stock of them has to be renewed at short intervals, as the bee's life does not usually exceed a single year. And yet the typical bee cell, with all its marvellous symmetry and complexity, finished with the precision of a 100,000th part of an inch, has not changed the length of one of its lines since it first excited the astonishment of man. With this known amount of invariability, how great is the time that would be requisite for developing the instinct of a bee into human reason?

But here it is necessary that instinct should be sharply distinguished from some of the other powers with which it is generally accompanied. No one denies that the brutes have certain mental endowments in common with men. They have appetites, propensities, desires, affections, memory, simple imagination or the power of reproducing the sensible past in mental pictures, and even judgment of the simple or intuitive kind. They compare and judge, as when the dog or cat decides correctly what height or breadth it can safely jump, or how large an orifice must be to admit the pas-

sage of its body. But they cannot judge by inference, or through the intervention of a third term ; that is, they cannot reason. They cannot generalize their experience, and thus form premises from which many conclusions can be drawn. Their judgment, as intuitive, is always of the particular case presented to their senses, and never as an inference from a general rule. The only end which they can pursue, or even contemplate, apart from the guidance of instinct, is particular and immediate; dictated by the appetite or impulse of the moment. Hence, they cannot combine means for the attainment of a future or general object, and thus their modes of operation are never altered or improved.

Instinct is the power given to compensate for these deficiencies, which would otherwise be fatal to life or destructive of the species. It appears as a substitute for reason, not as a lower degree of it ; it answers the same purpose, but by totally different means. Instinct is the performance by an animal of some act (the construction of a nest or cell, or the laying of a stratagem for catching its prey) which man could not perform without intelligence or reason, properly so called ; that is, without experience or instruction, the observation of effects, the induction of a rule or law from them, and the consequent future choice and adaptation of means to ends. This act the animal demonstrably performs without either experience or instruction, but just as blindly as the bird tucks its head under its wing when going to sleep, without knowing why. The act does tend to some useful end, though the animal knows not of it. Foresight it has none, unless it be the foresight of a god rather than a man ; for human prescience is nothing but the reflection of the past upon the mirror of the future. Neither reason nor instinct supplies an object of endeavor, but only points out the means of attainment, the former relying exclusively upon experience, the latter appearing, at least to human observation, to be guided by inspiration. A blind propensity induces the duckling to take to water ; instinct teaches it how to swim. The migratory bird is urged by a vague impulse at the proper season to change its country ; instinct turns its flight in the right direction. Surely it would be no improvement in either of these cases, no development of a higher faculty out of a lower one of the same kind, if reason were substituted for instinct, the tardy and uncertain teachings of experience for the instantaneous and unerring guidance of inspiration. That power or faculty, call it what we may, bears not the remotest semblance of human reason which teaches a wasp, born only after the death of its parents, to store up food of a kind which it never uses for itself, for the use of its young which it is never to see. Neither a propensity nor an appetite is an instinct, though all three are equally blind. For



man also has both propensities and appetites which need not the promptings of intellect, but are awakened before reason is born in him. Tastes, smells, and sounds are pleasant or odious to him as a matter of original constitution, and not because his reason tells him that these ought to be sought, and those to be avoided.

This is not an arbitrary definition or limitation of the meaning of the word *instinct*; for if, as Mr. Darwin says, human reason is to be developed out of the brute's endowments, be these what they may, — if man is the son of a monkey, and the grandson of a horse, and the remote descendant of an oyster, — then reason must grow out of something which has at least some characteristic of reason, or which does the work of reason; and not from something which even now, in man, has no resemblance to intellect properly so called, and no dependence upon it, and which appears fully even in an idiot. Tell me that reason has been developed out of instinct *as it has now been defined*, and at least I know what you mean; but to say that it has been evolved from an appetite or a propensity, is as incomprehensible as to allege that an idea has been developed out of a football. No conceivable variation of a football will approximate it to reason. Mr. Darwin's supposed cases of incipient, altered, or lost instincts are, at best, only instances of the development or disappearance of blind impulses or appetites, which relate only to the selection of ends to be obtained, and not to devising new means, or improving old ones, of obtaining them. He has not adduced one case of the variation of instinct properly so called.

Any form of the Development Theory rests ultimately upon the assumption, that the origin of species by a direct act of creation is inconceivable, or at best grossly improbable. Mr. Darwin, as already mentioned, speaks with wonder of those who are "no more startled at a miraculous act of creation than at an ordinary birth." And Professor Parsons, in a communication upon the same subject to this Academy, declared that, whatever difficulties might impede the reception of the transmutation hypothesis, "I should accept them all unhesitatingly, rather than the notion that the first horse, or dog, or eagle, or whale flashed into being out of nothingness, or out of a mass of inorganic elements which had been drawn together in due proportion for that purpose."

In opposition to this view, it is here maintained that a direct act of creation is no more inconceivable, and not inconceivable in any other sense, than an ordinary birth. It excites more wonder, it is true; but only because it is less frequent, or because it is believed to take place more abruptly. A new individual — a new being — is the result in either case; but to assert that the beginning of this new existence is more explicable

by ordinary generation than by direct creation, is equivalent to saying (if the folly and irreverence of the expression may be pardoned), "that a horse should create a horse is conceivable; but that God should create a horse is inconceivable." The beginning of all life is in a nucleated cell of microscopic size. The original formation of such a cell, and the subsequent enlargement or rather multiplication of it by the epigenesis of other similar cells, are distinct acts of creation properly so called, whether preceded or not by a generative union of the parents. That the generative act should be ordinarily followed by the vivification of such a cell, is a law of nature, which, like other natural laws, does not explain the phenomena, nor throw any light upon them, but merely describes and classifies them; and if naturalists were once led to believe the union of two sexes to be a necessary or invariable antecedent of the vivification, the discovered fact of parthenogenesis has convinced them of their mistake. The first appearance, then, of this living cell, is an indubitable case of an organized individual at once "flashed into being," not indeed "out of nothingness," but "out of a mass of inorganic elements drawn together in due proportion for that purpose"; and special or miraculous creation, which appears so incredible or inconceivable to the advocates of the Development Theory, is in fact constantly going on all around us. Whether we call it creation or ordinary generation, the process — the mode in which inorganic particles are suddenly bound together into an organic living whole — is wholly inexplicable. Science throws down her microscope before the process in despair. But inexplicable as it is, we are not able to deny that it is a law of nature which is perpetually verified before us. We cannot tell *how* a blade of grass grows; but we do not therefore affirm that it does not grow.

No one who understands the case will assert, that either the scale on which the phenomenon takes place, or the frequency of its repetition, or the length of time within which it is completed, is a radically distinguishing circumstance which prevents us from identifying ordinary reproduction with direct creation. Frequent repetition, indeed, wears out wonder; but it does not make the process one whit more explicable than if it occurred only once in a millennium. One microscopic germ may be slowly developed into a giant pine, which may reckon its years by centuries; and another may give birth to an insect that completes its whole cycle of being in a single season. But science knows as little of the process in the one case as in the other, and justly classes them both under the same name of generative development. "If an animal or a vegetable," says Dugald Stewart, "were brought into being before our eyes *in an instant of time*, the event would not be in itself more wonderful than their *slow growth* to matu-

rity from an embryo or from a seed. But on the former supposition, there is no man who would not perceive and acknowledge the immediate agency of an intelligent cause; whereas, according to the actual order of things, the effect steals so insensibly on the observation, that it excites little or no curiosity, excepting in those who possess a sufficient degree of reflection to contrast the present state of the objects around them with their first origin, and with the progressive stages of their existence."